Spark og HDFS

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# Lese/skrive CSV/PARQUET filer

Før vi kan begynne å lage aggregeringer, må vi gjøre datasettene om til Parquet filer. Det er alltid lurt å gjøre om til Parquet først, siden de tilbyr komprimering.

**Kode for lesing/skriving**

val myDf = spark.read.option("header","true").csv("student-performance.csv")

myDf.write.format(’parquet’).option(’header’,’true’).mode(’overwrite’).save(’student-performance.parquet’)

val PDF = spark.read.option("header","true").parquet("student-performance.parquet")

## Student Performance Dataset (KV-database)

**First aggregation**{

val result1 = PDF.groupBy("Fedu").agg(expr(" avg(G1) as FirstYear"), expr( " avg(G2) as SecondYear"),expr( " avg(G3) as ThirdYear"))

val result2 = PDF.groupBy("Medu").agg(expr(" avg(G1) as FirstYear"), expr( " avg(G2) as SecondYear"),expr( " avg(G3) as ThirdYear"))

val joined = result1.joinWith(result2, result1("Fedu") === result2("Medu"))

val temp = joined.selectExpr("\_1 as Father, "\_2 as Mother")

val temp2 = temp.select(col("Father.\*"),col("Mother.\*"))

val flattenTemp = temp2.toDF("FatherEdu","FFirstYear","FSecondYear","FThirdYear", "MotherEdu","MFirstYear","MSecondYear","MThirdYear")

flattenTemp.write.format("csv").option("header","true").mode("overwrite").save("grades-average.csv")

}

**Second aggregation** {

val temp = PDF.groupBy("studytime").agg(expr(" avg(G1) as FirstYear"), expr( " avg(G2) as SecondYear"),expr( " avg(G3) as ThirdYear"))

val setString = udf {(freetime: Integer) => if(freetime == 1) "Very little" else if(freetime == 2) "Little" else if(freetime == 3) "Medium" else if(freetime == 4) "Much" else "Very Much"}

val temp2 = temp.withColumn("freetime", setString(temp("freetime")))

temp2.write.format("csv").option("header","true").mode("overwrite").save("freetime-grades.csv")

}

**Third aggregation**{

val temp = PDF.groupBy("studytime").agg(expr(" avg(G1) as FirstYear"), expr( " avg(G2) as SecondYear"),expr( " avg(G3) as ThirdYear"))

val setString = udf {(studytime: Integer) => if(studytime == 1) "Very little" else if(studytime == 2) "Little" else if( studytime == 3) "Medium" else if( studytime == 4) "Much" else "Very Much"}

val temp2 = temp.withColumn("studytime", setString(temp("studytime")))

temp2.write.format("csv").option("header","true").mode("overwrite").save("studytime-grades.csv")

}

## Socio-Economic Country Profiles (Dokumentdatabase)

**First aggregation**{

val temp = myDf.select("country", "Population in thousands (2017)", "GDP: Gross domestic product (million current US$)","GDP per capita (current US$)","Unemployment (% of labour force)","Population growth rate (average annual %)","Urban population (% of total population)\_x","Urban population growth rate (average annual %)","Health: Total expenditure (% of GDP)","Education: Government expenditure (% of GDP)","Individuals using the Internet (per 100 inhabitants)","Quality Of Life Index","Purchasing Power Index","Safety Index","Health Care Index","Property price to income ratio","Affordability Index","Cost Of Living Index","Cost Of Living Plus Rent Index","Life expectancy at birth, total (years)","Military expenditure (% of GDP)", Tax revenue (% of GDP)")

temp.write.option(’header’,’true’).mode(’overwrite’).parquet(’country-profiles-trimmed.parquet’)

val customSchema = StructType(Array(StructField("country",StringType, true),

StructField("Population in thousands (2017)", IntegerType, true),

StructField("GDP: Gross domestic product (million current US$)", DoubleType, true),

StructField("GDP per capita (current US$)", DoubleType, true),

StructField("Unemployment (% of labour force)", DoubleType, true),

StructField("Population growth rate (average annual %)", DoubleType, true),

StructField("Urban population (% of total population)\_x", DoubleType, true),

StructField("Urban population growth rate (average annual %)", DoubleType, true),

StructField("Health: Total expenditure (% of GDP)", DoubleType, true),

StructField("Education: Government expenditure (% of GDP)", DoubleType, true),

StructField("Individuals using the Internet (per 100 inhabitants)", IntegerType, true),

StructField("Quality Of Life Index", DoubleType, true),

StructField("Purchasing Power Index", DoubleType, true),

StructField("Safety Index", DoubleType, true),

StructField("Health Care Index", DoubleType,true),

StructField("Property price to income ratio", DoubleType,true),

StructField("Affordability Index", DoubleType, true),

StructField("Cost Of Living Index", DoubleType, true),

StructField("Cost Of Living Plus Rent Index", DoubleType, true),

StructField("Life expectancy at birth, total (years)", DoubleType, true),

StructField("Military expenditure (% of GDP)", DoubleType, true),

StructField("Tax revenue (% of GDP)", DoubleType,true))

val myDf = spark.read.option("header","true").option(’customSchema’, ’true’).parquet("country-profiles.parquet")

val oldCol = Seq("country", "Population in thousands (2017)", "GDP: Gross domestic product (million current US$)","GDP per capita (current US$)","Unemployment (% of labour force)","Population growth rate (average annual %)","Urban population (% of total population)\_x","Urban population growth rate (average annual %)","Health: Total expenditure (% of GDP)","Education: Government expenditure (% of GDP)","Individuals using the Internet (per 100 inhabitants)","Quality Of Life Index","Purchasing Power Index","Safety Index","Health Care Index","Property price to income ratio","Affordability Index","Cost Of Living Index","Cost Of Living Plus Rent Index","Life expectancy at birth, total (years)","Military expenditure (% of GDP)", "Tax revenue (% of GDP)" )

val newCol = Seq("country", "population", "gdp", "gdpPerCapita","unemployment", "populationGrowthRate", "urbanPop","urbanPopGrowth", "healthTotal", "educationTotal", "internetUsers", "qualityOfLifeI", "PPI", "safetyI", "HealthI", "propPriceToIncome","affordabilityI", "costI", "costPlusRentI", "lifeExpectancy", "militaryTotal", "taxes")

val list = oldCol.zip(newCol).map(f=>{col(f.\_1).as(f.\_2)})

val newDF = myDf.select(list:\_\*)

newDF.write.format("csv").mode("overwrite").option("header", true).save("country-profiles.csv")

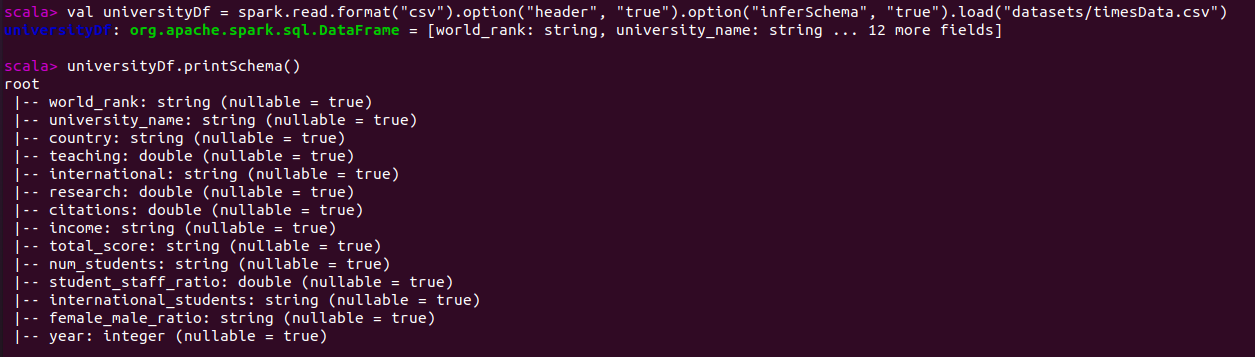
}

**Second aggregation**  {

val thisTemp = PDF.coalesce(1).select(col("country"), expr("(costPlusRentI / 100) \* gdp as RealCost ")).sort(desc("RealCost"))

}

## World University Rankings (Kolonnefamiliedatabase)

Først leser vi csv filen med «inferSchema» satt til «true» for å opprette schema.

Jeg legger merke til at noen av datatypene ikke stemmer. Jeg ser at «world\_rank» er satt til streng, selv om det tilsynelatende er int. Men det går fin, siden den også inneholder verdier som «100-150» lenger ned i datasettet. Derimot, «international» var satt til streng, fordi null-verdier var byttet ut med

## Government Types Of The World (Grafdatabase)

asd

# Endringer på nettsiden

På grunn av endringene i komponentene …

# HDFS

**Listing/remove**

hadoop fs -ls hdfs:/// -rm

**Read from HDFS**

val PDF = spark.read.option("header","true").option("inferSchema","true").load("hdfs:///country-profiles.parquet")

val PDF = spark.read.option("header","true").parquet("hdfs://localhost:9000/filepath")

(.csv() kommando hvis fil er av type CSV)

**Copy from local to HDFS**

hadoop fs -copyFromLocal country-profiles.parquet /country-profiles.parquet

hadoop fs -copyFromLocal university\_write.parquet /university-write.parquet

hadoop fs -copyFromLocal student-performance.parquet /student-performance.parquet

hadoop fs -copyFromLocal reign\_write.parquet /reign-write.parquet

hadoop fs -copyFromLocal regime\_write.parquet /regime-write.parquet

hadoop fs -copyFromLocal leader\_write.parquet /leader-write.parquet

hadoop fs -copyFromLocal election\_write.parquet /election-write.parquet

//-copyToLocal for motsatt

**Hva skjer egentlig?**

Det første vi gjør er å kopiere de lokale parquet-filene til HDFS, det vil fungere ca slik:

1. ber namenode om å opprette en fil. Namenode vil returnere en liste over noder for å lage replika blokker (første replika er lokalt plassert, andre på en annen rack, tredje på samme rack som replika 2)

-Bare en replika per node

-To replika per rack(om det er nok racks)

2. blokkdata skrives da til første node i namenode listen

3. ber namenode å hente ut neste sett med blokklokasjoner, skriv blokken

4. iformerer namenode om at filen er ferdig skrevet og gjør filen tilgjengelig

Nå som det er lagret på noder i HDFS kan vi da hente ut parquet-filene derfra via Spark med read-kommando og gjøre aggregeringer.

**Eks:**

1. I average-grades.csv aggregeringen(aggregering 1) henter først ut hele listen fra HDFS og legger det i en dataframe.

2. Etter det lages det to Row() elementer som holder på hver sin del av dataen, en for fars utdanning og en for mors.

3. Etter det gjør vi en joinWith på dataen, og legger de sammen basert på verdien i utdanningsnivå som er 0-4.

4. Når har vi en dataframe bestående av to structs som vi bytter navn på

5. Vi «flater» så ut struct-typen som har blitt skapt av den tidligere joinWith for å pakke ut til to hovedgrupper.

6. Til slutt skrives filen til disk som csv fil, eller den kan skrives til HDFS.

